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TRANSLATION

RIBONUCLEINIC ACID AS A STIMULATOR OF ALGAE GROWTH

By

V. P. Vendt and I. G. Drokova

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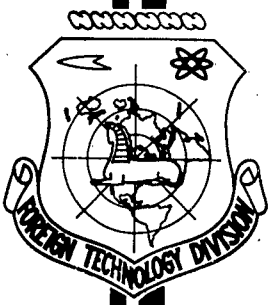

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Ribonucleinic Acid as a Stimulator of Algae Growth

by

V. P. Vendt and I. G. Drokova

Nucleinic acid belongs to highly important biological substances. These acids participate not only in the construction of protoplasma and its organoidas, but also in most bariegated processes of metabolism. They play a very important role in the biosynthesis of albumin, multiplication and growth of living organisms. Nucleinic acids should be considered as one of the factors, which plays the basic role in the accumulation of biomass of organisms, which are by nature, most firmly connected with the biosynthesis of albumin. From this viewpoint it is interesting to point toward the recent investigations, devoted to the study of the role of ribonucleinic acid in the initial stage of synthesizing albumin molecules.

A comparison was recently made of the investigation results by Hoagland, Zamecnik and associates 1927, Tongur 1960, confirmed and detailed analyzed by other investigators (Dickson, Webb, 1961), during which was revealed and investigated the fermentative system of activating amino acids, which is the first stage of albumin biosynthesis.

The discovery of the process of activating amino acids led to intensive examination of the nature of the entire reaction and enabled to formulate such equations as (Hoagland, 1955; Berg, 1956; Hoagland and others, 1957; Wieland and others, 1956, Allen and others, 1960).

$$\text{Amino acid} + \text{AMF} + \text{activating ferment} \rightleftarrows \text{amino acyl} - \text{AMF-Ferment} + \text{PP}.$$

Later on it was shown, that the formed complex, which contains amino acid in its active form enters into combination with a solution of ribonucleinic acid following such a reaction.

$$\text{Aminoacyl-AMF-Ferment} + \text{PHK} \rightleftarrows \text{Amino acid} - \text{PHK} + \text{AMF} + \text{ferment}.$$

Without going into any details, we will designate only, that in cytoplasma cells exist over 20 specific activation ferments, each one of which reacts with a certain amino acid (Kochetkov and others,1961). Plasma juice of amino acid activated with a fermentation system is immediately accepted by a PHK solution, which binds them quite formly and "transfers " into microsomas, where they are utilized for the construction of albumin molecule. All these data have been obtained very recently. They created very great interest and are being quite intensively discussed and further developed. But in our opinion, already at the given stage of investigating the degree of participation of various PHK forms in the synthesis of albumim, it would be possible to make practically important conclusions,especially when studying the stimulation of the biomass concentration process of certain simple organisms.

Taking all this into consideration, we found it advisable to explain the effect of a solution of PHK form on the concentrations of biomass of chlorella pyrenoidosa Chick alga; Scenedesmus quadricauda (Turp) Breb and Dunaliella salina Teod algae when cultivated under lab conditions. The selection of these algae types was prompted first of all on account of their practical values and the relative simplicity of germinating same.

Taking into consideration that a solution of the PHK type is non specific and that it has identical properties regardless of the object, from which it has been separated, in our investigations we have used the PHK compound,obtained from yeasts.

The molecular weight of the ribonucleinic acid applied by us (close to 15000), according to literature data (Tongur 1960) corresponds approximately to the molecular weight of the PHK type solution .

Given below are the results of our own experiments.

Investigation on Chlorella pyrenoidosa Chick

The alga was grown on Craig Trelise nutritive solution (Bold,1942). The solution prior to sewing the alga was sterilized. Ribonucleinic acid was

added on the 4-th, 8-th and 12-th days after planting Ch.pyrenoidosa in the amount of 50 mg per 250 ml of solution. The concentrated biomass of alga was measured nephelometrically.

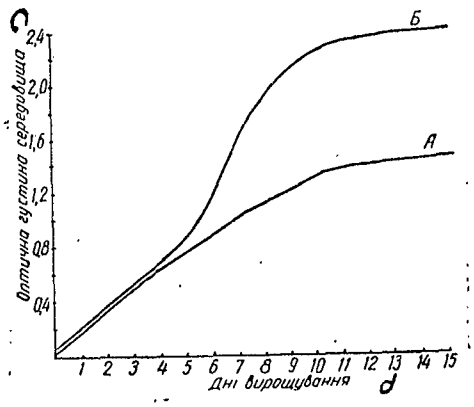

Fig.1. Concentrated biomass Chlorella pyrenoidosa: A-control; B-+ PHK; c-optical density of medium; d-days of cultivation.

In fig.1. are given results of one of the many investigations. It should be pointed out, that in other investigations the results are no different from the above mentioned by more than 10-15%. This also took place in investigations on other algae. The data in the drawing show, that the addition of PHK into the cultivating medium leads to considerable concentration of biomass. And so for example, on the tenth-twelfth day in the investigated culture of Ch.pyrenoidosa biomass was doubly greater than in the control.

Investigations of Scenedesmus quadricauda (Turp.) Breb

The Scenedesmus quadricauda alga was cultivated on a Knop medium (Bold,1942, Baslavskaya and others,1956). The solution was sterilized prior to planting.Ribonucleinic acid was added on the day of planting S.quadricauda in the amount of 200 mg per one liter of medium.

The results of the investigation were given in fig.2.

Just as in the case of culture Ch.pyrenoidosa, is revealed the stimulating action of PHK on the concentration of alga biomass. On the 8-th and 10-th days the amount of cells in the presence of PHK grew by more than 1.8 times.

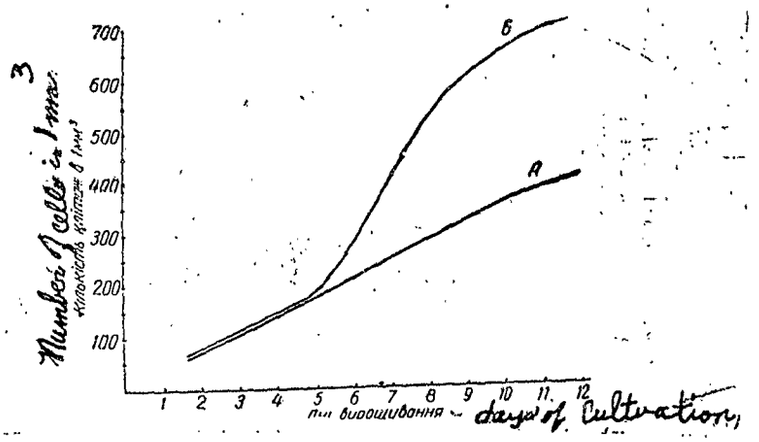

Fig.2. Concentration of biomass of Scenedesmus quadricauda;
A-control; B-+ РНК

Studying Dunaliella salina Teod.

The Dunaliella salina alga was cultivated on nutritive Artari solution (Artari, 1916). The РНК compound was added on the second day of planting in the amount of 200 mg per 1 liter of the medium. The number of cells was counted every five days.

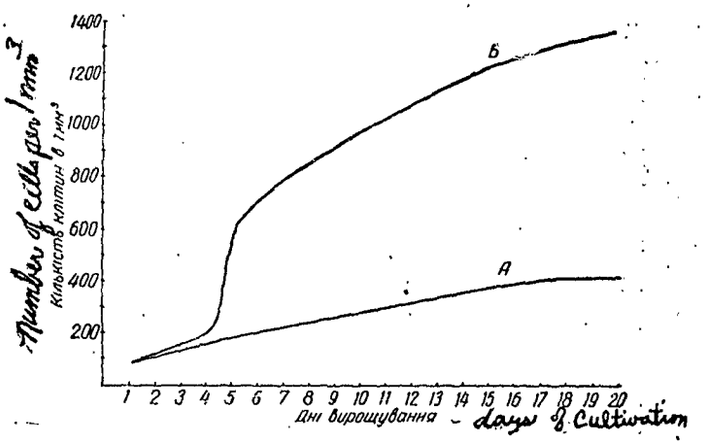

Fig.3. Concentration of Dunaliella salina biomass :
A-control; B-+ РНК

Results of the investigation are given in drawing 3.

It is evident from the drawing, that the stimulating effect of ribonucleinic acid is perfectly clear also for salt water algae.

Conclusions.

Additional introduction into the culture medium of a low polymeric solution of ribonucleinic acid leads to considerable stimulation of the growth and concentration of biomass of Chlorella pyrenoidosa Chick, Scenedesmus Quadricauda (Turp.)Breb, Dunaliella salina Teod algae.

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